

The opinion in support of the decision being entered
today (1) was not written for publication and
(2) is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JOHN ZHIQIANG WANG

Appeal No. 2005-1316
Application 09/735,503¹

ON BRIEF

Before PAK, KRATZ, and TIMM, Administrative Patent Judges.

PAK, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1 through 4 and 6 through 8, which are all the claims pending in the above-identified application.

¹ Application for patent filed December 14, 2000.

APPEALED SUBJECT MATTER

The subject matter on appeal is directed to gas turbine bucket (blade) construction, wherein a natural frequency of the turbine bucket (blade) is "tuned" using secondary orientation. See the specification, pages 1 and 4. The selection of the secondary orientation (placement of a crystal seed along a desired direction) "effect[s] a desired percentage change in turbine bucket natural frequencies." See the specification, page 4. This percentage change, in turn, improves fatigue resistance of the turbine bucket (blade). See the specification, page 1, lines 10-19 and page 3, lines 14-15. Details of the appealed subject matter are recited in representative claims 1 and 6², which are reproduced below:

1. A method of manufacturing a turbine bucket comprising:
 - (a) investment casting the turbine bucket with a single crystal alloy; and
 - (b) tuning a natural frequency of the turbine bucket without modifying physical features of the turbine bucket, wherein step (b) is practiced by, prior to step (a), placing a crystal seed along a desired direction

² According to the appellant (Brief, page 4), "[c]laims 2-4 stand or fall together with claim 1 and claims 7 and 8 stand or fall together with claim 6." Therefore, for purposes of this appeal, we select claims 1 and 6 and decide the propriety of the examiner's Section 102(b) rejection set forth in the Answer based on these claims consistent with 37 CFR § 1.192(c)(7)(2003) and 37 CFR § 41.37(c)(1) (vii) (2004).

according to an orientation including all angles between 0°-90° relative to an engine axial direction to thereby effect a desired percentage change in the natural frequency of the turbine bucket.

6. A method of tuning turbine bucket natural frequency comprising:

(a) placing a crystal seed along a desired orientation including all angles between 0°-90° relative to an engine axial direction; and

(b) investment casting the turbine bucket with a single crystal alloy, wherein the desired orientation is selected to tune torsional frequencies without affecting flexure frequencies and to effect a desired percentage change in the turbine bucket natural frequency.

PRIOR ART

The sole prior art reference relied upon by the examiner is:

Gemma et al. (Gemma) 4,605,452 Aug. 12, 1986

REJECTION

Claims 1 through 4 and 6 through 8 stand rejected under 35 U.S.C. § 102(b) as anticipated by the disclosure of Gemma.

OPINION

We have carefully reviewed the claims, specification and applied prior art, including all of the arguments advanced by both the examiner and the appellant in support of their respective positions. This review has led us to conclude that the examiner's Section 102 rejection is well founded.

Accordingly, we will sustain the examiner's Section 102(b) rejection for those factual findings set forth in the Answer. We add the following primarily for emphasis and completeness.

Under Section 102, anticipation is established only when a single prior art reference discloses, either expressly or under the principles of inherency, each and every element of a claimed invention. *See In re Spada*, 911 F.2d 705, 708, 15 USPQ2d 1655, 1657 (Fed. Cir. 1990); *RCA Corp. v. Applied Digital Data Systems, Inc.*, 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984). The law of anticipation, however, does not require that the prior art reference teach the appellants' purpose disclosed in the specification, but only that the claims on appeal "read on" something disclosed in the prior art reference. *See Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 772, 218 USPQ 781, 789 (Fed. Cir. 1983).

Here, there is no dispute that Gemma discloses the manufacturing of a turbine blade (bucket) comprising the claimed sequence of "investment casting the turbine blade with a single crystal having controlled secondary crystallographic orientation" Compare the Answer, page 3, with the Brief and the Reply Brief in their entirety and see also Gemma, the abstract,

together with Gemma, column 14, line 45 to column 15, line 18.

Nor is there any dispute that:

The single crystal [of Gemma] is placed in a desired orientation *including all angles from 0 to 90 degrees* (col. 13, lines 1-6) to provide a better fatigue resistance (col. 3, lines 10-50). *The orientation of the seed is preferred between zero and twenty degrees* (col. 3, lines 39-41, col. 12, lines 52-65). The secondary orientation would not affect the turbine blade's weight, the turbine blade's shape, or the flexure mode of the turbine blade, since the flexure frequencies is [sic, are] insensitive to the secondary orientation as acknowledged ... by [the] applicant (page 3, lines 24-26 of [the] applicant's specification). (Emphasis in original)

Although the examiner acknowledges that Gemma is silent with respect to the tuning of a natural frequency of the turbine blade (bucket), the examiner takes the position that such tuning "is inherent that every time when Gemma ... arrange[s] the crystal seed to a different orientation, at any angle, the natural frequency has been tuned to a different value." See the Answer, page 3. In other words, the examiner finds that Gemma, by virtue of placing its single crystal seed in an orientation (direction) useful for improving fatigue resistance, necessarily or inherently obtains the corresponding desired percentage change in the natural frequency of the turbine blade (bucket).

The appellant argues (Reply Brief, pages 1 and 2) that:

In paragraph (10) of the Examiner's Answer, the Examiner maintains that "it is inherent that every time when Gemma et al. arrange the crystal seed to a different orientation, at any angle, the natural frequency has been tuned to a different value."

Although Appellant may not necessarily disagree with this statement, Appellant respectfully submits that even assuming its accuracy, the claimed invention does not result. As noted previously, in the Gemma patent, the method to optimize fatigue is to set the secondary orientation such that the orientation is tangent to the blade surface in the critical crack prone regions just behind the leading edge of the airfoil at about 40-80% of the airfoil span. The effect of the crystal orientation on natural frequency is irrelevant to the Gemma method, resulting in some random, non-specific value. The claimed invention, in contrast, with reference to claim 1 for example, defines a step of tuning a natural frequency of the turbine bucket . . . by placing a crystal seed along a desired direction . . . to thereby effect a desired percentage change in the natural frequency of the turbine bucket. Thus, by this invention, a specific natural frequency percentage change can be effected by placing the crystal seed along a specific direction. This direction is known and the result is known and not merely a random consequence of actions toward another goal as in the Gemma method.

(Underlining emphasis in original. Bold emphasis added)

We are not persuaded by the appellant's argument.

As found by the examiner (Answer, page 3), Gemma, like the appellant, teaches orienting the single crystal seed to a configuration (direction) useful for improving fatigue resistance of the turbine blade. Also, there is no dispute that this orientation of the single crystal seed necessarily or inherently tunes a natural frequency of the turbine blade, i.e., effects a

percentage change in the natural frequency of the turbine blade. See the Reply Brief, page 1, together with claim 1 on appeal which recites "placing a crystal seed along a desired direction according to an orientation...thereby effect a desired percentage change in the natural frequency of the turbine bucket". Although Gemma does not recognize the importance of obtaining a so-called "desired percentage change" in the natural frequency of the turbine blade, it, by virtue of placing the single crystal seed in a direction desirable for improving fatigue resistance of a turbine blade, necessarily or inherently causes a corresponding percentage change in a natural frequency of the turbine blade, which is also desirable for improving fatigue resistance of the turbine blade. The natural frequency percentage change necessarily or inherently obtained in Gemma is not precluded by the claimed so-called "desired percentage change" in a natural frequency of the turbine blade, which is no more than a function of the desired direction of the crystal seed.

CONCLUSION

In view of the factual findings set forth in the Answer and above, we determine that the examiner has established a *prima facie* case of anticipation which has not been sufficiently rebutted by

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the appellant. Accordingly, we affirm the examiner's decision rejecting the claims on appeal under Section 102(b).

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a)(1)(iv).

AFFIRMED



CHUNG K. PAK)
Administrative Patent Judge)



PETER F. KRATZ)
Administrative Patent Judge)

BOARD OF PATENT
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CATHERINE TIMM)
Administrative Patent Judge)

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